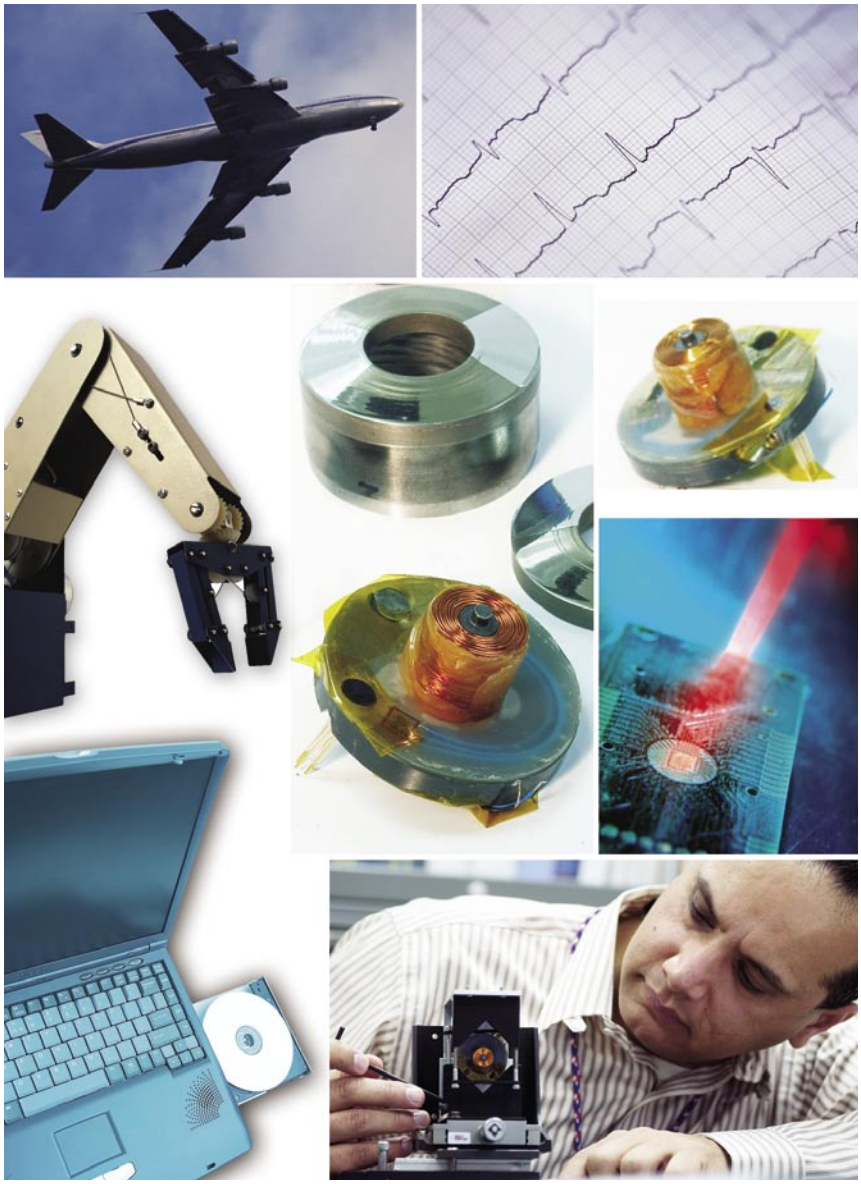
technology ■ opportunity

National Aeronautics and Space Administration
www.nasa.gov

electromechanical devices

# Long-Life, Low-Power, Precise Miniature Probe or Pump

...for biomedical, computer, industrial, aerospace, and other applications using small actuators



**NASA Goddard Space Flight Center** invites companies to license an innovative actuator technology for use as a probe or pump in commercial applications. This small, lightweight, low-power actuator technology can make highly precise adjustments. As a result, the actuator can serve as a flow or pressure sensor (probe), can precisely move a fluid (pump), or provide other capabilities for a wide range of applications.

## Benefits

- **Simple, reliable**: The electromagnetic actuator has only one moving part, promising a long design life and minimizing contamination from wear particulates or lubricating agents.
- **Small**: The actuator motor can be as small as 0.5 inches in diameter and 1.5 inches long with a stroke of 0.1 to 0.15 inches.
- **Precise**: The actuator offers controllable displacement steps on the order of tenths of microns.
- **Low power**: This actuator is powered by a conventional battery and can consume as little as 2 or 3 watts.
- **Low heat production**: Because the actuator has a single moving part, production of heat is reduced.

## Applications

This technology can benefit any application where a relatively small, long-life, precise actuator is needed:

- **Biomedicine**: Intracardial/ Intrauterine pressure sensors, dialysis membrane sensors, miniature infusion and insulin pumps, ventricular assist devices (VADs), artificial hearts, mechanisms for expanding coronary stents
- **Computers**: Disk-eject mechanisms, disk drive read/write systems
- **Industrial**: Robotic assembly; in-line sampling for nuclear, biohazardous, or other dangerous environments
- **Electronics**: Semiconductor fabrication, optical communications
- **Aerospace**: Drag reduction, flight control surface actuation, active vibration/ noise damping, long-life electromechanical instruments
- **Scientific instruments**: Genomic sequencing instruments, interferometers, medical imaging systems, microscopes

## Technology Details

### *How it works*

The motors typically used to move space telescope mirrors precisely in many degrees of freedom are relatively large and consume large amounts of power. A researcher at NASA Goddard Space Flight Center has developed an alternative technology that provides greater precision in a smaller, lighter package that uses less power and has only one moving part. This technology—an electromagnetic levitating linear motor—has been developed into probe and pump designs.

The electromagnetic actuator motor has one moving part: a magnetically levitated shaft. This design eliminates the need for bearings and promises a long design life. Furthermore, unlike a solenoid motor, which is typically limited to two positions, this motor achieves displacement steps of as small as a tenth of a micron. The frictionless design eliminates the need for bearings or lubricating agents and reduces heat production. The actuator design can be as small as 0.5 inches in diameter and 1.5 inches long with a stroke of 0.1 to 0.15 inches.

The Goddard inventor integrated the actuator into a probe design that can be used as a flow or pressure sensor for implantable biomedical pumps, such as a ventricular assist device (VAD) or an artificial heart. Yet the probe's applications are not limited to biomedicine. The probe-actuator design could be useful in computers and scientific instruments as well as in industrial and aerospace applications.

The actuator also could be combined with a pump design to provide precise volume metering. A new pump design could be developed, or the actuator might be compatible with an existing pump design. This pump would be designed to provide a flow rate of 8 liters/minute with 20 pounds of force. The pump is powered by a conventional battery and can consume as little as 2 or 3 watts. The pump would be useful in any fluid delivery system that requires precise volume metering.

NASA Goddard is pursuing patent protection for this technology.

## Partnering Opportunities

These devices are part of NASA's Innovative Partnerships Program, the goal of which is to transfer technologies into and out of NASA to benefit both NASA space missions and the American public. NASA invites companies to consider licensing the miniature actuator as a probe or pump for use in commercial applications.

## For More Information

If you are interested in the miniature actuator (GSC-14710-1), please contact:

**Office of Technology Transfer**
**NASA Goddard Space Flight Center**
**mini-actuator@gsfc.nasa.gov**

More information about working with NASA Goddard's Office of Technology Transfer is available online:
**http://techtransfer.gsfc.nasa.gov**